CLAIMS

What is claimed:

1. A method for the storage of hydrogen within a solid carbonaceous subterranean formation comprising:

(a) providing at least one well extending from the surface of the earth and penetrating into said solid carbonaceous formation;

(b) establishing a pressure gradient from said formation to the surface to desorb methane contained within said solid carbonaceous formation and producing methane from said formation through said well to a surface methane recovery facility;

(c) subsequent to the recovery of methane from said formation, injecting gaseous hydrogen through said well and into said solid carbonaceous formation;

(d) continuing the injection of hydrogen into said subterranean formation under a pressure sufficient and in an amount sufficient to cause injected hydrogen to be absorbed within the matrix of said carbonatious formation; and

(e) subsequent to the storage of hydrogen within said solid carbonaceous formation establishing a pressure gradient from said carbonaceous formation to the surface to withdraw previously introduced hydrogen to the surface.

2. The method of claim 1 further comprising establishing a plurality of wells extending from the surface of the earth into said subterranean formation and withdrawing methane and introducing hydrogen through at least a portion of said plurality of wells.

3. The method of claim 1 wherein said hydrogen is stored within said subterranean formation at a pressure within the range of 0.1 – 0.5 psi per foot of depth of said subterranean formation.

4. The method of claim 1 wherein said subterranean formation is a coal bed formation.

5. The method of claim 4 wherein the said coal bed is only partially depleted of methane at the time gaseous hydrogen is introduced into said formation.

6. The method of claim 4 wherein a common well is used for both the recovery of methane from said coal bed formation and the introduction of hydrogen into said coal bed formation.

7. The method of claim 4 wherein the amount of hydrogen introduced into said coal bed formation is within the range of 0.2 – 1.0 standard cubic feet for each cubic foot of methane recovered from said coal bed formation.

8. The method of claim 4 wherein said coal bed formation is mechanically fractured to produce fissures within said coal bed formation.

9. The method of claim 4 wherein a plurality of wells spaced from one another extend from the surface of the earth into said formation and further comprising, withdrawing methane and introducing hydrogen through said wells to establish a pattern in which hydrogen is absorbed into said formation in portions of said formation previously depleted of methane.

10. The method of claim 4 wherein said coal bed formation is characterized by an orientation of face cleats providing for a predominant direction of flow within said formation and said hydrogen gas is injected into said formation employing a configuration of a plurality of wells in which fluid flow is predominantly along the orientation of said face cleats.

11. The method of claim 4 wherein the recovery of methane from said formation is preceded by the production of water from said formation.

12. The method of claim 11 wherein hydrogen is injected through a plurality of wells from which water has been previously produced.

13. The method of claim 12 wherein water is recovered from said formation in an amount to reduce the water content of the formation at the time of hydrogen injection to a value of 20 volume percent or less of the original water in said formation.

14. The method of claim 10 wherein said plurality of wells are configured in a well pattern comprising rows of wells which are spaced in the direction of the face cleat orientation of said formation, said rows of wells comprising individual rows which are spaced one from another along the butt cleat orientation of the formation, the spacing of said wells being less than the spacing between rows of said wells.

15. The method of claim 14 wherein the ratio of the spacing between the rows of said wells to the average spacing of wells within an individual row is at least 1:1.

16. The method of claim 14 wherein the ratio of the spacing between the rows of said wells to the average spacing of wells within an individual row is at least 2:1.

17. A method for the storage of hydrogen within a solid carbonaceous subterranean formation comprising:

(a) providing a plurality of wells extending from the surface of the earth and penetrating into said solid carbonaceous formation;

(b) establishing a pressure gradient from said formation to the surface to desorb methane contained within said solid carbonaceous formation and producing methane from said formation through at least some of said wells to a surface methane recovery facility;

(c) subsequent to the recovery of methane from said formation, injecting an inert gas through at least some of said wells and into said solid carbonaceous formation to establish a mixture of said inert gas and methane within said formation and reduce the methane partial pressure within said formation;

(d) withdrawing a mixture of methane and said inert gas from said formation through at least some of said wells;

(e) subsequent to the recovery of said mixture of methane and said inert gas, injecting gaseous hydrogen into said formation through at least some of said wells and continuing the injection of hydrogen into said subterranean formation under a pressure sufficient and in an amount sufficient to cause injected hydrogen to be absorbed within the matrix of said carbonaceous formation; and

(f) subsequent to the storage of hydrogen within said solid carbonaceous formation establishing a pressure gradient from said carbonaceous formation to the surface to withdraw previously introduced hydrogen to the surface.

18. The method of claim 17 wherein said subterranean formation is a coal bed formation.

19. The method of claim 18 wherein said inert gas is nitrogen.

20. The method of claim 19 wherein the recovery of methane from said formation is preceded by the production of water from said formation prior to the introduction of said inert gas into said formation.